

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of: Dussinger et al.

Serial No. : Not yet known

Filing Date: Herewith

For: INTEGRATED CIRCUIT HEAT PIPE HEAT SPREADER WITH  
THROUGH MOUNTING HOLES

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

**PRELIMINARY AMENDMENT**

Preliminary to the examination of the above-identified Continuation Application,  
please amend the Application as follows:

**IN THE SPECIFICATION:**

At page 1, on the line between the title and "§1. Background of the Invention" ,  
insert the following claim of priority:

- - This application is a continuation application of copending U.S. Application  
Serial No. 09/310,397, filed on May 12, 1999. - -

Please replace the paragraph on page 6, starting on line 11, with the following  
rewritten paragraph:

- - Fig. 3 is a plan view of an internal surface of the contact plate of the preferred  
embodiment of the invention showing the region of the capillary wick constructed of  
sintered higher heat conductivity powder. - -

Docket No.: H1799-00071

Please replace the paragraph on page 8, starting on line 3, with the following rewritten paragraph:

- - In the present invention, heat pipe 10 also has capillary wick pillars 32 which bridge the space between contact plate 18 and cover plate 20. Pillars 32 thereby interconnect cover plate 20 and contact plate 18 with continuous capillary wick. This geometry assures that, even if heat pipe 10 is oriented so that cover plate 20 is lower than contact plate 18, liquid condensed upon inner surface 34 of cover plate 20 will still be in contact with capillary pillars 32. The liquid will therefore be moved back to inner surface 28 which functions as the evaporator because it is in contact with a heat generating integrated circuit (not shown). Capillary pillars 32 are wrapped around and supported by depressions 26, which prevents the structurally weaker capillary pillars 32 from suffering any damage. - -

Please replace the paragraph on page 10, starting on line 10, with the following rewritten paragraph:

- - The only differences between heat pipe 11 of Fig. 2 and heat pipe 10 of Fig. 1 are that finned heat sink 16 is not shown in Fig. 2, lips 22 and 24 are slightly longer in Fig. 2 to accommodate holes 48, and hole 50 is shown. In fact, through holes 12 shown in Fig. 1 are also included in Fig. 2. Although it is unlikely that holes 12, holes 48, and hole 50 would be used in the same assembly, manufacturing economies may make it desirable to produce all the holes in every heat pipe so that the same heat pipe heat spreader can be used with different configurations of finned heat sinks. The unused sets of holes have no effect on the operation or benefits of the invention. - -

#### IN THE CLAIMS

Please cancel claims 1-7 without prejudice.

Add new claims 8-22 as follows:

8. (New Claim) A heat pipe for spreading heat comprising:  
a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber;

at least one depression formed in said first plate which projects into said vapor chamber and is bonded to said second plate; and

an opening defined through said at least one depression and said second plate wherein said opening is isolated from said vapor chamber.

9. (New Claim) A heat pipe for spreading heat according to claim 8 comprising at least one spacer positioned within said vapor chamber and extending between and contacting said first and second plates.

10. (New Claim) A heat pipe for spreading heat according to claim 8 wherein said spaced-apart first and second plates include confronting interior surfaces; and

a wick positioned upon said confronting interior surfaces including that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.

11. (New Claim) A heat pipe for spreading heat according to claim 10 wherein said wick is constructed with at least two separate sections of different materials, with one section being located on said first plate interior surface and being formed of a material with higher heat conductivity than sections located on said second plate interior surface.

12. (New Claim) A heat pipe for spreading heat according to claim 8 wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate.

13. (New Claim) A heat pipe for spreading heat according to claim 8 wherein said first and second plates each include a peripheral lip located at an edge of said boundary structure which are bonded together.

14. (New Claim) A heat pipe for spreading heat comprising:  
a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber;  
at least one depression formed in said first plate which projects into said vapor chamber and is bonded to said second plate;  
an opening defined through said first plate depression and said second plate wherein said opening is isolated from said vapor chamber; and  
at least one depression formed in said second plate which projects into said vapor chamber and is bonded to said first plate.

15. (New Claim) A heat pipe for spreading heat according to claim 14 wherein said at least one depression formed in said second plate comprises a flat portion that is in contact with an inner surface of said first plate.

16. (New Claim) A heat pipe for spreading heat according to claim 14 wherein said spaced-apart first and second plates include confronting interior surfaces; and  
a wick positioned upon said confronting interior surfaces including that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.

17. (New Claim) A heat pipe for spreading heat comprising:  
a boundary structure including spaced-apart first and second plates that define an enclosed vapor chamber;  
at least one hollow column positioned within said vapor chamber and sealingly bonded to said first and second plates, having an open first end that opens through said

first plate and an open second end that opens through said second plate so as to form at least one mounting hole that is isolated from said vapor chamber.

18. (New Claim) A heat pipe for spreading heat according to claim 17 wherein said spaced-apart first and second plates include confronting interior surfaces; and a wick positioned upon said confronting interior surfaces of said first and second plates the exterior surface of said at least one hollow column disposed within said vapor chamber.

19. (New Claim) A heat pipe for spreading heat comprising:  
a boundary structure including a first plate and a second plate arranged in spaced apart relation, each of said plates including interior confronting surfaces and a peripheral lip located at an edge of said boundary structure which are bonded together so as to define an enclosed vapor chamber;

at least one depression formed in said first plate which projects into said vapor chamber, is spaced from said peripheral lip, and is bonded to said second plate;

an opening defined through said first plate depression and said second plate wherein said depression comprises an annular outer surface that is bonded to a corresponding annular edge surface in said second plate and further wherein said opening is isolated from said vapor chamber;

at least one spacer extending between and contacting said first and second plates; and

a wick positioned upon said confronting interior surfaces including that portion of the interior surface of said first plate that forms a surface of said depression within said vapor chamber.

20. (New Claim) A heat pipe for spreading heat comprising:  
a first plate having a circumferential edge lip bounding an inner surface and at least one hollow column that is integral with said first plate and which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate, said edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

said at least one hollow column being bonded at one end to said second plate so as to coaxially align said at least one hollow column with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate and said second plate and is isolated from said vapor chamber.

21. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and at least one depression which projects outwardly relative to said inner surface;;

a second plate arranged in spaced apart confronting relation to said first plate and including a circumferential edge lip bounding an inner surface and at least one opening through said second plate, said edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

said at least one depression has an open ended tubular cross-section and an outer surface, a portion of which outer surface is bonded to said second plate so as to coaxially align said at least one depression with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

22. (New Claim) A heat pipe for spreading heat comprising:

a first plate having a circumferential edge lip bounding an inner surface and at least one depression which projects outwardly relative to said inner surface;

a second plate arranged in spaced apart confronting relation to said first plate and including (i) a circumferential edge lip bounding an inner surface, (ii) at least one depression which projects into said vapor chamber and that is bonded to said inner surface of said first plate, and (iii) at least one opening through said second plate, said

edge lips of said first and second plates being bonded together so as to define a vapor chamber; wherein

said at least one depression in said first plate has a tubular cross-section that opens at a first end and a second end and is bonded to said second plate at said second end so as to coaxially align said at least one first plate depression with said at least one opening in said second plate thereby to form a mounting hole that extends through said first plate depression and said second plate and is isolated from said vapor chamber.

FILED OCT 10 2019

REMARKS

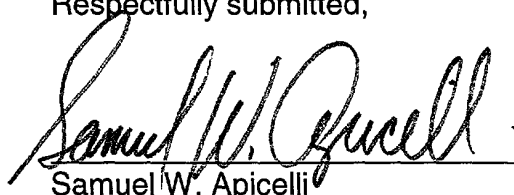
Upon entry of this Preliminary Amendment into the above-identified Continuing Application, claims 8-22 will be under active consideration in the application.

Claims 1-7 have been cancelled without prejudice. Applicants have added new claims 8-22 so as to define further patentable aspects of the invention. Applicants have also amended the specification to correct informalities identified in the parent application Serial No. 09/310,397. No new matter has been entered into the application as a result of these additions to the application. Claims 8-22 are allowable. Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

Accordingly, Applicants respectfully request the issuance of a Notice of Allowability for this case. Early and favorable consideration is respectfully requested.

Respectfully submitted,

Dated: 5/9/01



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**Version with markings to show changes made.**

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- - In the present invention, heat pipe 10 also has capillary wick pillars 32 which bridge the space between contact plate 18 and cover plate 20. Pillars 32 thereby interconnect cover plate 20 [16] and contact plate18 [14] with continuous capillary wick. This geometry assures that, even if heat pipe 10 is oriented so that cover plate 20 [16] is lower than contact plate 18 [14], liquid condensed upon inner surface 34 of cover plate 20 will still be in contact with capillary pillars 32. The liquid will therefore be moved back to inner [raised] surface 28 which functions as the evaporator because it is in contact with a heat generating integrated circuit (not shown). Capillary pillars 32 are wrapped around and supported by depressions 26, which prevents the structurally weaker capillary pillars 32 from suffering any damage. - -

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